

CLAIMS

What is claimed is:

- 1 1. A method, comprising determining a schedule for transmission times of various segments
2 of digital content across multiple channels so as to permit any number of content consumers
3 to begin playback of said segments of digital content from an origination point thereof within
4 a waiting time of a request for such playback.
- 1 2. The method of claim 1 wherein the various segments of digital content together comprise
2 a movie.
- 1 3. The method of claim 2 wherein the schedule is determined according to an earliest-
2 deadline-first (EDF) process.
- 1 4. The method of claim 3 wherein in the EDF process a next transmission time for one of the
2 various segments of digital content is determined by first finding an earliest deadline amongst
3 a list of current deadlines for each of the various segments and selecting this segment for
4 transmission.
- 1 5. The method of claim 4 wherein the earliest deadline so chosen is verified to be later than a
2 finishing time for a last transmitted segment.
- 1 6. The method of claim 4 wherein a new deadline for transmission of the selected segment is
2 determined according to $T + t_i + t_d$, where T is a beginning time for the transmission of the
3 selected segment, i is a segment number for the selected segment, t_i is the playback time of
4 segment i and t_d is the waiting time.

- 1 7. The method of claim 2 wherein a cost function is associated with each of the various
2 segments scheduled for transmission, and a segment with the lowest of the cost functions is
3 selected to be transmitted next.
- 1 8. The method of claim 7 wherein the cost function comprises wasted bandwidth.
- 1 9. The method of claim 2 wherein the schedule is determined according to a just-in-time (JIT)
2 process.
- 1 10. The method of claim 9 wherein the JIT process schedules each of the various segments
2 for transmission as close to a transmission deadline associated with each segment as possible.
- 1 11. The method of claim 10 wherein in the JIT process, conflicts for transmissions over the
2 multiple channels are resolved by scheduling a segment with an earlier playback time closer
3 to its deadline for transmission than a segment with a later playback time.
- 1 12. The method of claim 10 wherein in the JIT process, the transmission deadline associated
2 with a particular one of the segments is determined as a time equal to a current time plus a
3 playback time for that particular one of the segments plus the waiting time.
- 1 13. The method of claim 4 wherein in the EDF process, the deadlines associated with the
2 various segments are computed according to a process wherein conflicts for transmissions
3 over the multiple channels are resolved by scheduling a segment with an earlier playback
4 time closer to its deadline for transmission than a segment with a later playback time.
- 5 14. The method of claim 2 wherein the schedule is determined according to a periodic
6 transmission process.

1 15. The method of claim 14 wherein the periodic transmission process allows a broadcast
2 schedule for the movie to be repeated every period time, the period time being equal to an
3 integral multiple of a length of the movie.

1 16. The method of claim 14 wherein each one of the multiple segments is allocated to a
2 transmission queue number of a transmission schedule table according to a number of times
3 equal to a movie period divided by the sum of the waiting time and a playback time for such
4 one segment.

1 17. The method of claim 15 wherein all of the segments allocated to a single one of the
2 multiple channels form a pseudo-movie, and all such pseudo-movies for all of the multiple
3 channels are input to multiple channels of a transmission head-end.

4 18. A method, comprising:

- 5 i. dividing a multimedia presentation into sequential segments, each segment
6 having a time length,
- 7 ii. scheduling transmission of the segments of the multimedia presentation
8 according to a schedule computed according to a specified delay time that
9 does not depend on the time lengths of the segments, and
- 10 iii. transmitting the segments over a broadcast network according to the schedule
11 for each segment computed in step ii.

1 19. The method of claim 18 wherein a transmission bandwidth of multiple times that of the
2 multimedia presentation is allocated for transmission of the segments and each segment is
3 transmitted repeatedly based on the computed schedule.

1 20. The method of claim 18 wherein early segments are transmitted more frequently than
2 later segments.

1 21. The method of claim 18 further comprising receiving the segments transmitted over the
2 broadcast network, storing the segments in temporary storage, and playing back the segments
3 as soon as the delay time has elapsed.

1 22. A method as in claim 18 wherein each of the segments is scheduled for repeated
2 transmissions at periodic times.

1 23. A method as in claim 22 wherein the periodic times for transmission of each respective
2 segments equals time offsets of the beginning of such respective segment plus an operator
3 selected delay time.

1 24. A method as in claim 18 wherein segments having earlier transmission deadlines are
2 scheduled first and as soon as possible.

1 25. A method as in claim 18 wherein segments are transmitted just-in-time as determined by
2 respective time offsets and the specified delay.

1 26. A method as in claim 25 wherein in the case of a conflict where more of the segments are
2 to be transmitted than allocated bandwidth allows, segments later in the presentation are
3 scheduled to be transmitted earlier in nearest empty time slots, giving priority to earlier
4 segments to be transmitted as closely as possible to their scheduled time slots.

1 27. A method as in claim 18 further comprising computing an overlap period between an end
2 of a current presentation and a beginning of a next presentation, to minimize interruptions
3 therebetween.

1 28. A server configured to generate transmission schedules for each of a number of segments
2 of a multimedia presentation to be transmitted over a multiple channels of a broadcast
3 network, said schedules computed according to a specified delay time that does not depend
4 on time lengths of the segments.

1 29. The server of claim 28 wherein the transmission schedules are computed according to one
2 of a just-in-time transmission (JIT) procedure, an earliest-deadline-first (EDF) procedure or a
3 periodic transmission procedure.

1 30. The server of claim 29 wherein according to the EDF procedure a next segment to be
2 transmitted is determined by first finding an earliest transmission deadline amongst a list of
3 current transmission deadlines for each of the segments and selecting this segment for
4 transmission.

1 31. The server of claim 29 wherein according to the JIT procedure each of the segments are
2 scheduled for transmission as close to a transmission deadline associated with each segment
3 as possible.

1 32. The server of claim 29 wherein according to the periodic transmission procedure each of
2 the segments is allocated to a transmission queue according to a schedule that takes into
3 account a period of the presentation, the delay time and a playback time for each segment.

1 33. A receiver configured to receive segments of multimedia presentation from multiple
2 transmission channels simultaneously and to begin playback of the segments in a sequence
3 corresponding to a proper format for the multimedia presentation after a predetermined delay
4 time that is independent of time lengths of the segments.

1 34. The receiver of claim 33 wherein the segments are stored on a local storage medium.

1 35. The receiver of claim 33 wherein the segments are received according to a schedule that
2 was computed according to one of a just-in-time transmission (JIT) procedure, an earliest-
3 deadline-first (EDF) procedure, a combination of aspects of the EDF and JIT procedures, or a
4 periodic transmission procedure.